AN ANCIENT READING OF FINGER-PRINTS.

BY LOUIS ROBINSON, M.D.

SINCE Francis Galton published his classic work on Finger-Prints in 1892, every one has become more or less familiar with the curious scroll-like patterns made by covering the front surface of the fingers with printer's ink and then pressing them on paper. At the present time they are attracting a great deal of attention among the police authorities, all over the world, as a means of establishing personal identity beyond dispute. In fact, this branch of anthropological study may be said, for the time being, to have passed out of the hands of men of science into those of the investigators of crime.

I hope, however, in the ensuing pages, to show that Science has not said her last word about finger-prints: and, moreover, that inferences bearing on the psychic side of human nature are to be drawn from a close scrutiny of their curved linear markings quite other than those grossly practical inferences drawn by the gaoler and the detective.

Galton aptly compares the tiny ridges upon the fingers, which reveal themselves in the prints, to ripples left upon the sand by wind or running-water. He gives a most exhaustive analysis of their arrangement, and proves that they are permanent throughout life. His technical instructions as to the best method of obtaining the prints appear to be equally exhaustive; for, in giving the composition of various inks which may be employed for the purpose, he includes one made use of by the present writer when recording a newly born infant's footprints with such materials as he chanced to find in a pauper's tenement at midnight, viz., lamp-soot, ink, soap, and syrup. But, in discussing the true natural history of the minute ridges upon the fingers, Galton goes no further than did the first physiologist of note who drew

attention to their presence. This was Dr. Nehemiah Grew, an almost forgotten worthy, who gave an account of his observations in a paper read before The Royal Society in the year 1684. Oddly enough, Galton, whose paper on "Patterns in Thumb and Finger Marks" came before the same august body just 207 years later, appears never to have heard of the observations of Nehemiah Grew, which are still to be found in the Society's Proceedings. At any rate, in tracing the history of finger-study, Galton goes back no further than Purkenje, of Breslau, whose thesis dealing with the minute patterns on the fingers was published in 1823.

Nehemiah Grew, who was the son of Obadiah Grew, an eminent Puritan divine, was elected Secretary of the Royal Society in 1671, and probably held that coveted position at the time when the essay above alluded to was read. He was by no means the least notable of that band of eager students of science, who made the reign of King Charles II almost as much a time of scientific awakening as the Italian Renaissance was a time of artistic awakening. Probably, the discoveries of the illustrious William Harvey, who first revealed the truth as to the circulation of the blood, had a great deal to do with arousing this new interest in the wonders of nature. Nehemiah Grew was born in 1641, a few months before Sir Isaac Newton, and among his contemporaries were Harvey; Leuwenhoek, the pioneer with the microscope; Edward Tyson, who first dissected a chimpanzee, and published his results under the title, "The Anatomie of a Pygmie"; Sir Hans Sloane; Leibnitz; Halley the astronomer; Dr. Sydenham, one of the greatest reformers in Medicine; and Sir Thomas Browne, the gentle philosopher of Norwich, whose words quoted from the "Religio Medici,"

> "Search where thou wilt, and let thy Wisdom go,
> To ransom Truth, e'en to the Abyss below.
> Rally the scattered causes, and the line
> Which Nature twists be able to untwine,"

give admirable proof that the true scientific spirit animated the men of this seventeenth-century renaissance.

Nehemiah Grew, in his paper "On the Pores in the Skin of the Hands and Feet," says:

"If any one will but take the pains, with an indifferent glass, to survey the palms of his hands, very well washed with a ball, he may

perceive innumerable little ridges, of equal size and distance, and everywhere running parallel to each other. And especially on the ends and first joints of the fingers and thumb, on the top of the ball, and near the root of the thumb a little above the wrist. In all which places, they are very regularly disposed into spherical triangles and ellipses. On these ridges stand the pores, all in even rows, and of such a magnitude as to be visible to a good eye without a glass. But, being viewed with one, every pore looks like a little fountain, and the sweat may be seen to stand therein as clear as rock-water, and as often as it is wiped off, to spring up within them again.

"What Nature intends in the position of these ridges is, that they may the better suit with the use and motion of the hand. . . . On the ridges, the pores are very providently placed, and not in the furrows which lie between them: that so their structure might be the stronger, and less liable to be depraved by compression. . . . For the same reason, the pores are also very large, that they may still be the better preserved, though the skin be ever so much compressed and condensed by the constant use and labor of the hand."

This quaint and graphic description (which, by the way, gives us a rather startling insight as to the average state of cleanliness among *savants* during that godly age, seeing that the details of the skin were presumed to remain invisible until the hands had been "very well washed with a ball") may enable us to read new meanings in finger-prints when subjected to a close scrutiny.

When magnified three or four diameters, the lines are found to bear a curious resemblance to blurred lines of print. This is owing to the fact that the cuplike pores, to which Dr. Nehemiah Grew draws attention, almost break the continuity of the lines, giving them somewhat the appearance of a series of letters and words which have partly run together.

It will be seen that he accounts for the existence of the minute ridges by reference to the protection which these give to the openings of the sweat-glands. Galton seems to have arrived at almost the same conclusion, for he says:

"The uses of the ridges are primarily, as I suppose, to raise the mouths of the ducts, so that the excretions which they pour out may the more easily be got rid of; and, also, in some obscure way, to assist the sense of touch."

Galton also draws attention to the fact, that the ridges show most upon hands subjected to friction. They are, in fact, much more pronounced in the horny-handed "knight of labor" than in those lighter-fingered "*chevaliers d'industrie*" in whose finger-

marks certain official students of Galton's new science take such a strenuous interest. Now, this fact, together with certain others to which attention was drawn by Galton—viz., that the ridges are very prominent on the hands of all apes, and also upon the naked under surface of the prehensile tails of South-American monkeys —should suffice to afford a simpler and more correct explanation of their primary use and origin. That the ridges appear most plainly where the skin is thickened by use is *prima facie* evidence that they are needed more in such spots than elsewhere.

We have continually to go back to the arboreal stage of man's existence in order to account for certain peculiarities in his anatomical structure; and, when the peculiarity in question is one which he still shares with the apes, strong proofs exist that it was evolved to meet the needs of a life among the high branches. Now, it is somewhat strange that, among the reasons given by learned physiologists for the existence of the filelike ridges on the hands and fingers, their very obvious use in giving a better grip seems to have been ignored. That such was their chief function during man's early history there can be very little doubt, for, although, as Galton suggests, they may also aid in giving a discriminating sense of touch, this appears quite insufficient to account for their distribution. Nor is such a function obsolete at the present day. Any one who has had his finger-ends temporarily worn smooth (as by rubbing with pumice-stone) knows how much their power of holding small and slippery objects, such as needles and fine scientific instruments, is decreased. In fact, the system of serried ridges on the hand gives us a security of hold such as does the artificial roughening on the haft of a knife.

Moreover, it is not difficult to show that both the presence of the sweat-glands and their position on the ridges are exactly calculated to secure a like end. Their main function becomes obvious enough when one considers the sudden demand for (and supply of) adventitious moisture shown by every workman when he wishes to get a good grip of his tools. It is noteworthy that the perspiration from the palms of the hands and the soles of the feet is quite free from that greasy element which characterizes the exudations of the skin glands over the rest of the body. It is, as Dr. Nehemiah Grew pointed out, "as clear as rock-water."

Now let us consider in what way moistening the hands tends

to increase their grip. It immediately calls to the aid of the flexor muscles one of the great forces of nature, viz., the pressure of the atmosphere. Every one knows the clinging power of a piece of wet rubber or leather tightly pressed against some smooth surface. Among the lower orders of creatures, especially among the aquatic molluscs, this aid in maintaining a hold is secured by various elaborate means. Among insects it is very common, but appears to be enhanced in some cases by a sticky exudation from the feet. Some of the lower vertebrates, such as tree-frogs and gecko lizards, have little suckers upon their finger-tips, and can walk up a pane of glass almost as well as a fly. Among mammals, such a gift is rare, although several of the lemuroid group possess it to a certain extent.

Marvellous to relate, one of the most flylike among the higher mammals in this respect appears to be the hippopotamus, the soles of whose feet, at birth, are soft and cuplike, thus enabling the little creature to cling securely by "suction" to the smooth, wet surface of its dam's back, as she plunges about in the African rivers.

It is plain, of course, that in the human hand atmospheric pressure can be nothing like so effective as in the case of the holding organs of any of these creatures. The very ridges themselves, with their intervening valleys, would prevent a total exclusion of the air. But for this apparent defect there is a very good reason. Not only does the hand of a man, or ape, require to grip tightly; it must also let go quickly. Otherwise, among our humble relations who live in the trees, rapid movements from branch to branch would be impossible. In fact, it appears to be a general rule that all true sucker-footed creatures (insects excepted) are sluggish and deliberate in their movements, because it takes time to readmit the air and so release the limb.

A simian or human hand, when wet, and closely applied to a moderately smooth surface, must be regarded as a multitude of tiny suckers rather than one large one. It gains the advantage of atmospheric pressure chiefly on the flattened-out ridges, with their myriads of minute cuplike pores (each of which, being wet with perspiration, is a perfect little sucker), while the gripping muscles are in strong action. The moment these relax, the air finds its way back again along the intervening furrows, so that the hand can be moved without the least difficulty.

Confining our attention for the moment to apes and monkeys—whose palmar and plantar ridges are covered with sweat-pores exactly like our own—let us consider whether there is any special provision for meeting those emergencies when a secure grip is of supreme importance. Now, it appears to be an almost universal rule among wild creatures that rapid and violent movements are never made except under the influence of excitement. Among predatory animals, it may be the excitement of pursuit; but, in the case of the great majority, fear is the chief cause of rapid movements. An apparent exception exists in the case of young creatures at play; but, even here, the emotions are usually deeply stirred, for a child playing at hide-and-seek will await capture with beating heart and trembling limbs.

Now, in all works on the expression of the emotions, the fact is pointed out that sweat breaks out freely on the skin under the influence of extreme fear. But neither Darwin, nor any other writer whom I have consulted, alludes to the well-known fact that, in certain milder phases of this emotion, it is *the hands and feet* which perspire, while the rest of the body remains comparatively unaffected. It is plain that, since a wet hand gives a safer hold than a dry one, any terror-stricken ape in danger of falling from the trees would gain by this automatic association between the palmar sweat-glands and the emotion of fear. Here let me suggest that our curious inbred fear of falling, and also those "falling dreams" which every one experiences, may be relics of those times when a fall (in the physical sense) was the chief danger which threatened our remote ancestors—a danger which had to be guarded against by unremitting vigilance. Most people on seeing some one who seems to be in danger of falling—such as a workman at the edge of a high roof or scaffold—feel a tingling and moisture of the palms and soles, together with a tendency for the fingers and toes to curl downwards, as if trying to secure a firm hold. That the higher apes manifest a kindred sympathy for a fellow creature in like peril, I learned some years ago, when studying the ways of a young chimpanzee exhibited at the Westminster Aquarium. While a trapeze performance was going on, the little creature watched the daring evolutions of the gymnasts with anxious eyes and clutching fingers, and its agitation became painfully intense when one performer (a girl) ascended to the high roof and dived head foremost into a net. I repeatedly

noticed that its hands were wet with perspiration when excited in this way, but did not at the time discern the meaning of the phenomenon. As the performer dropped out of sight of the ape (which was behind a screen), before one heard the "smack" of her contact with the canvas-covered net, the nebulous mind of the sympathetic little beast probably interpreted the last act as a fearful tragedy. At any rate, there was evidence that it had an intuitive knowledge of the danger accompanying a fall from a height, otherwise one cannot account for the real agitation and distress which it exhibited.

Now, there can be no doubt that, when we are considering the nervous mechanism of emotion, we must go very far back indeed in our ancestral history to account for commonly observed facts. Although civilization has made our lives infinitely complex, and although the hopes and fears which now most deeply move us are such as no brute could ever dream of, the physical accompaniments and consequences of our emotions to-day are almost precisely the same as when those emotions were only evoked by brute instincts. Practically, nothing has been added to the machinery of the emotions since our forefathers loved, or fought, or fled, among the inaccessible tree-tops.

Falling from a height has long ceased to be one of the deadly and constant dangers that threaten us. We are mainly dependent now, not upon our power to hold on to the branches in time of danger, but upon our power of holding our own with our fellow men. It is for this reason that people will sacrifice comfort and health, and will pour out money like water, for the sake of maintaining, or adding to, their social status. Hence a new "falling" terror has seized us, which is almost as dominant as the old. Darwin has pointed out that a social slip, although no more than a mere youthful *gaucherie,* or some trivial neglect of etiquette, which may bring us under the contempt of our fellows, awakens the emotion of shame far more than a serious transgression against the laws of ethics.

Now, what is the almost universal characteristic of the shy or timorous person who habitually feels himself walking in perilous places in society, and is conscious of being in imminent danger of making some slip of this kind? Is it not a damp hand?

Let me call as a witness that eminent expert on Average

Human Nature, Mr. Dooley of Chicago. In his narrative as to his first (and last) appearance as an orator he says: "But somehow, Hinnissy, th' minyit I looked down on what Hogan calls th' sea iv upturned faces dhrinkin', I began to feel onaisy. . . . I felt quare. . . . *I noticed that me hands were moist.*" Now, keen as is Mr. Dooley's mind in piercing to the bed-rock of things through any amount of the detritus of over-civilization, I doubt whether he realized that, on this occasion, he was guarding against an impending fall from greatness by invoking the weight of the earth's atmosphere.

Could there be a more striking example of the illimitable conservatism of Nature, and of the archaic machinery still at work within our bodies? Dame Nature has, apparently, not yet got used to the fact that we have come down from the trees and adopted newfangled terrestrial habits: for, when we feel bashful, or are moving in slippery places in "high society," or are otherwise in dread or distress, because—like Mr. Dooley when before the "Archey Road Improvement Comity,"—we seem threatened with a social downfall, she at once, with unfailing benevolence, meets the case by providing us with moist hands. Having thus done her part in getting her children out of a fix when in imminent danger of falling, she lets us alone to regain "harmony with our environment"—by the help of atmospheric pressure!

This I take to be one of the curious ancient readings which are to be found (partly, no doubt, "between the lines") in finger-prints.

LOUIS ROBINSON.